LUI | | | | | | | | | | | School code | | | | |

School name

Given name/s

Family name

Attach your barcode ID label here

Book of books used

External assessment 2023

Question and response book

Mathematical Methods

Paper 2 – Technology-active

Time allowed

- Perusal time — 5 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator **permitted**.
- QCAA formula book provided.
- Planning paper will not be marked.

Section 1 (10 marks)

- 10 multiple choice questions

Section 2 (45 marks)

- 9 short response questions

Clear zone — margin trimmed off after completion of assessment

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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Section 1

Instructions

- This section has 10 questions and is worth 10 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- Choose the best answer for Questions 1–10.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

	A	B	C	D
1.	○	○	○	○
2.	○	○	○	○
3.	○	○	○	○
4.	○	○	○	○
5.	○	○	○	○
6.	○	○	○	○
7.	○	○	○	○
8.	○	○	○	○
9.	○	○	○	○
10.	○	○	○	○

Ensure you have filled an answer bubble for each question.

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Section 2

Instructions

- Write using black or blue pen.
- Questions worth more than one mark require mathematical reasoning and/or working to be shown to support answers.
- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has nine questions and is worth 45 marks.

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QUESTION 11 (4 marks)

A researcher found that 17 out of 50 randomly selected people had used public transport in the past week.

a) Determine the sample proportion of people who had used public transport in the past week. *[1 mark]*

b) Determine an approximate 95% confidence interval for the proportion of people who had used public transport in the past week. *[2 marks]*

c) Someone claims that: *50% of people use public transport each week*.
Use your answer from Question 11b) to explain whether the data can or cannot support this claim. *[1 mark]*

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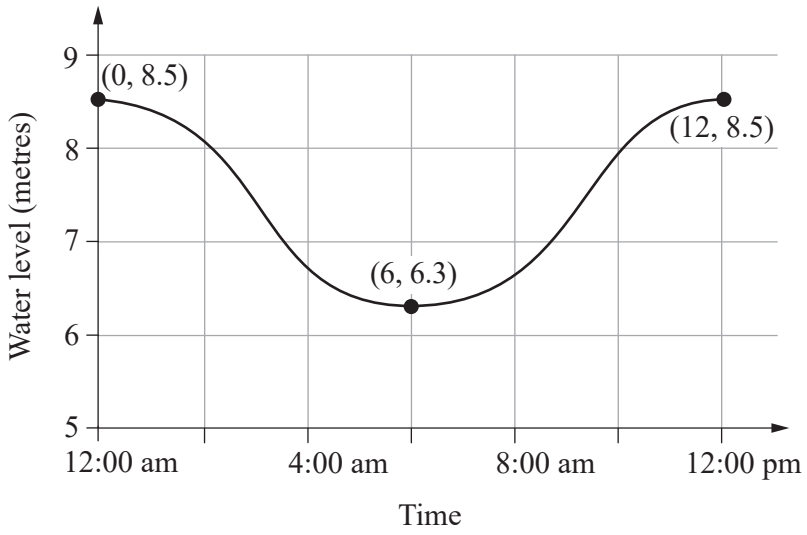
QUESTION 12 (4 marks)

The graph shows the water level under a bridge over a 12-hour period.



a) Determine the equation of the cosine function that models the water level as a function of time after 12:00 am. *[1 mark]*

b) How long in the 12-hour period shown is the rate of change of water level more than 0.55 metres per hour? *[3 marks]*

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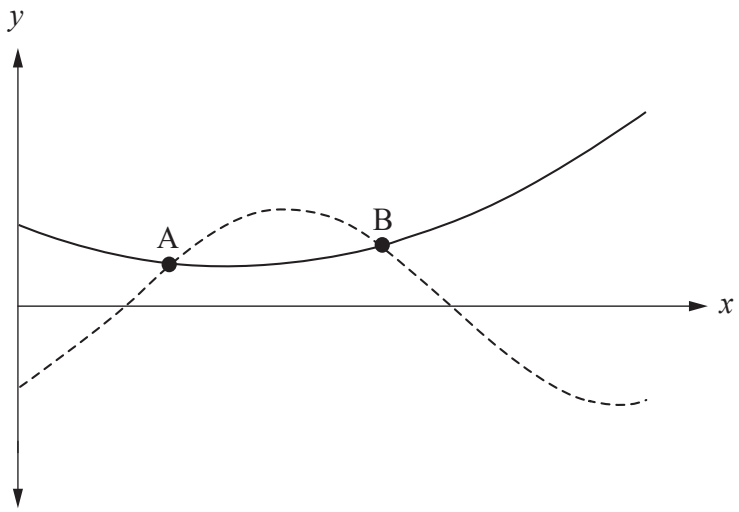
QUESTION 13 (4 marks)

The curved lines represent graphs of the equations $y = x^2 - 4x + 8$ and $y = 10\cos(x + 10)$.



a) Determine the coordinates of the points of intersection A and B. *[1 mark]*

b) State an integral expression representing the area enclosed by the two graphs. *[2 marks]*

c) Determine the area enclosed by the two graphs. *[1 mark]*

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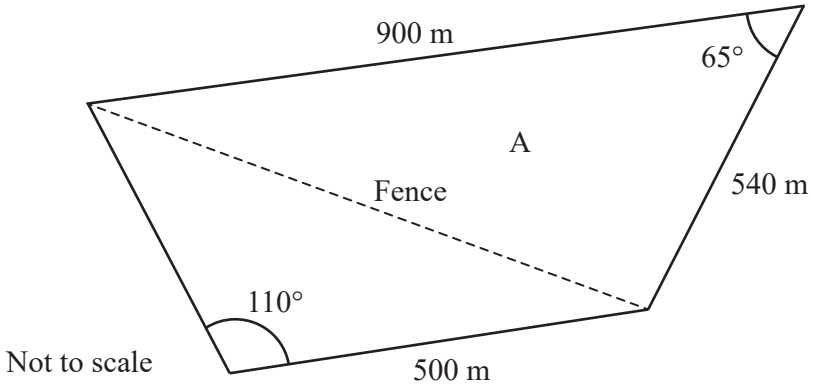
QUESTION 14 (7 marks)

A fence divides a paddock into two triangular sections as shown.



a) Determine the length of the fence. *[1 mark]*

b) Calculate the area of triangular section A. *[1 mark]*

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c) Determine the total area of the paddock. *[5 marks]*

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QUESTION 15 (4 marks)

Determine the derivative of $f(x) = \ln x^2 + \ln(x-5)^3$. Express the derivative as a single fraction in its simplest and factorised form.

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QUESTION 16 (6 marks)

A particle is moving in a straight line. The velocity (ms^{-1}) of the particle is given by

$v(t) = \dfrac{20\sin(2t)}{6-5\cos(2t)}$, $t \geq 0$, where t is time (s) after moving from its initial position.

The initial position of the particle is +6.0 m from the origin.

a) Use calculus methods to determine an equation for the position of the particle from the origin at any time t. *[3 marks]*

b) Determine the position of the particle relative to the origin when it first reaches maximum velocity. *[3 marks]*

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QUESTION 17 (5 marks)

Model bridges were constructed for a competition. The models that could support the heaviest loads before collapsing were given awards.

The load results of the competition were normally distributed, with a mean of 1.36 kg and a standard deviation of 0.12 kg.

Three award categories were used: honours for the top 15% of load results; distinction for the next 15%; and commendation for the next 15%.

The model bridge constructed by Finley only just missed out on a commendation. Kirby's model bridge only just qualified for honours. Determine the difference, to the nearest gram, between the loads supported by Finley and Kirby's models.

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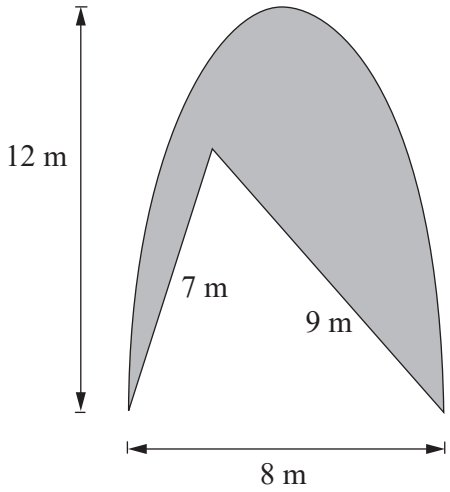
QUESTION 18 (5 marks)

A company makes windows using glass that has a mass of 5.6 kg per square metre. A customer orders an unusual window in a partial parabolic shape, as shown.

Not to scale



Determine the mass of the window.

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QUESTION 19 (6 marks)

Over a suitable domain, a hill has a cross-sectional area given by $\int h(x)\,dx = \frac{a}{b}e^{bx} + c$, where:

- a, b and c are constants, $b \neq 0$
- $h(x)$ represents vertical distance (m), x represents horizontal distance (m).

It is known that $h(0) = 1.22$ and $h(40) = 25$.

Where the gradient of the hill is 0.86 there is a tree stump. A second tree stump is located further up the hill. The difference in hill gradient between the two tree stumps is 0.44.

A surveyor predicts that the vertical distance separating the two tree stumps is between 7.5 m and 8.5 m. Evaluate the reasonableness of this prediction.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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